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**KAISER WILHELM INSTITUT FÜR
ARBEITPHYSIOLOGIE BAD EMS AND DIETZ**

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Date: 8 June 1945

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COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE

RESTRICTED

KAISER WILHELM INSTITUT FÜR ARBEITSPHYSIOLOGIE

AT

BAD EMS AND AT DIETZ a.d. LAHN

8 JUNE 1945

Reported by

Captain Charles L. McCarthy (M.C.) USNR, Hq. ETOUSA

Captain Carlo Henze, M.C., Hq. ETOUSA

CIOS TARGET NO. 24/107
MedicalCOMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division, SHAEF (Rear), APO 413RESTRICTED✓
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TABLE OF CONTENTS

<u>Subject</u>	<u>Page No.</u>
1. Description of Target.....	3
a. Organization.....	3
b. Physical Set-up.....	3
c. Staff.....	3
d. Scientific Program.....	3
2. Description of the Studies carried on	4
A. Theoretical Industrial Physiology	4
1. Physiological principles of muscular work.....	4
2. General principles of professional work.....	5
B. Practical Industrial Physiology.....	6
1. Description of external working conditions and their effect on workers.....	6
2. Measures recommended for increasing professional work output.....	6
3. Summarization of a portion of the Publications of the Institute for the years 1942 to 1944.....	8
a. publications dealing with the physiology or work and fatigue.....	8
b. publications dealing with miscellaneous subjects such as nutrition, industrial hygiene, physiology, etc....	14
4. Tcnhormone.....	16
5. Comments.....	16

Personnel of Team

Captain Charles L. McCarthy (M.C.) U.S.N.R.
 Captain Carlo Henze, M.C. Hq. ETOUSA.

1. Description of the Target

A. Organizations: In May 1944 this entire institute, known as the Kaiser Wilhelm Institut für Arbeitsphysiologie, was moved from Dortmund to Bad Ems a.d. Lahn, a small town of 12,000 persons about ten miles due east of Koblenz. Because of lack of space, a portion of the Institut was set up under the direction of Prof. Otto Graf at Dietz, three miles away. This is one of 36 similar institutes of the K. W. Gesellschaft for the advancement of science, with headquarters in Berlin. This foundation has succeeded in continuing independent scientific research under Hitler as it did in the days of the monarchy and the republic. Funds for its upkeep and the salaries of its staff were derived from industrial organizations such as the larger coal, iron and lead mining companies, the K.W.G., and especially endowments from private individuals. The annual expenses are about one-half million marks for the institute alone. During the period July 1, 1943 to July 1, 1944, 475,177 marks were received. The Institut has 100,000 marks on hand. Salaries amount to 20,000 marks monthly. It is estimated that funds on hand for salaries and current expenses are sufficient to last 3 months. Chemicals and other supplies now in stock will last 6 months. The last funds from the K.W.G. were received in March 1945. Electricity is used at present in all experiments as no gas is available. No coal will be needed until next winter.

b. Physical Set-up:- The institute is housed in a five storey brick and plaster building about 90 x 48 feet in size and known as the Four Towered House (Haus Vier Türme). The laboratory at Bad Ems occupies 40 large rooms while that at Dietz uses 10 rooms. The complete laboratory equipment, including many delicate instruments which were moved from Dortmund, has been repaired and has been in use for the past 10 months. Sufficient apparatus is on hand to conduct any contemplated work.

c. The Staff:

1. The Director is Prof. Dr. Gunther Lehman who was attached to the Luftwaffe during the war and who now is a prisoner of war. He has one scientific assistant and five technical assistants.

2. Prof. Dr. Henrick Kraut, head of the chemical department, is the acting director. He has 5 scientific assistants and 25 technical assistants. This department includes a smaller section working on the statistics of nutrition.

3. Prof. E.A. Müller, head of the physiological laboratory with two scientific assistants and 8 technical workers.

4. Prof. Dr. Otto Graf with 2 scientific assistants and 6 technical assistants in the branch physiological laboratory at Dietz.

5. Fifty-five additional persons are used as secretaries, workers in the diet kitchens, cleaners, etc.

d. Its Scientific Program: The Institut studied the problem of raising efficiency and lowering fatigue among workers by applying physiology and natural sciences in factories, mines and workshops. All influences effecting human efficiency were thoroughly examined, especially nutrition, drugs, climate and constitution. Bad working con-

ditions and unsuitable tools were improved by controlling the energy consumption and the movements of workers during work. Rest pauses were adapted to fit the individual rhythm of man. Methods for better use of these rest periods under factory conditions were studied and developed. About 120 papers on these studies on industrial physiology have been published since 1940. The arrival of these investigators was totally unexpected. They were able to see 16 different experiments going on during inspection of the target. The institut appeared to be very efficiently directed.

It was explained that this was the result of years of organisation under a carefully selected staff of scientific and technical assistants. It was further stated that no similar institut engaged solely in industrial physiology was to be found in Europe.

2. Description of the Studies carried on.

"Arbeitsphysiologie" was defined as the study of the physiological principles of human work and the application of its results to all occupations, having the welfare of workers as its ultimate object. Studies at the institut were made chiefly on workers in the mining industries, in the iron and steel industries, and in agriculture and forestry.

A. Theoretical Industrial Physiology.

1. Physiological principles of muscular work.

(a) The transformation of matter and energy in the organism during work: - The transformation in the organism of matter into energy during work, is the fundamental problem of theoretical "Arbeitsphysiologie". The methods of indirect calorimetry during short and long periods of work and also the ergometry of different muscles were improved in order to make possible the study of the influence on energy consumption of working speed, exercise, active motion of the body-parts, work involved in balancing and stabilizing the body, and of static effort. Connected with these problems are the questions of how to nourish an individual engaged in muscular work and how much protein, for example, has to be given, or how much vitamin B1 is necessary to assure complete transformation of all the carbohydrates in the food.

(b) Behaviour of the circulatory apparatus during work:- A good deal of research was carried out, to understand the oxygen supply to and the removal of waste products from the muscles as a limiting factor in maximal work and endurance. It was shown, that a static effort induces fatigue by impairing the blood supply to the muscles. To overcome this handicap, the organism increases circulation. The ratio of energy consumption to pulse rate has proved to be a valuable measure of the fatigue induced by a certain type of work.

(c) The Regulatory mechanism linking metabolism and circulation: The study of the nervous and hormonal mechanisms linking circulation

and metabolism is another field of their research. By developing a special method for the continued determination of adrenalin in the blood it was proved that this hormone effects the capacity for work (ergotrop reflex).

(d) The participation of the sensory organs and of the central nervous system in the performance of work;- The following items were dealt with:

1. Investigation of the coordination of sensory and motor performances involved in skilled and exacting work.
2. The knowledge of the general principles applying to an optimal arrangement of rest-pauses.
3. The study of the psychic "readiness" for work, especially its reactions with the sympathetic nervous-system.
4. The elucidation of the nature of "nervous exhaustion" certain types of work, and also the psychological problems effecting the limits of the "readiness" for work.
5. The pharmacology of work, especially the study of drugs used to increase work, or to reduce fatigue.

2. General principles of Professional Work.

(a) Physiological and psychological factors:- Many experiments were made to find out how professional work is influenced by age, constitution, individual ability and adaption. Abstaining from psychological vocational test, they concentrated on a few principal problems of physiological qualification, for instance, for heavy muscular work and for work in a standing position. They tried to predict the professional qualifications of apprentices from their anatomic and physiological traits, observing and comparing the development of apprentices in the iron industry and other occupations during several years of their training. It was investigated to what extent the daily output of a worker depends on sleep and recreation, on his disposition to work (f.i. adrenalin), on his will to work, on the demand for attention, and on alterations in working speed during the day (work curve).

External factors:- Recently a climatic chamber was constructed, in which work was going to be studied under various atmospheric conditions. In the course of these experiments, it was intended to investigate what type of artificial threads are best used for making worker's clothes.

The influence of ultra-violet rays and of water and salt in hot environments were tested. Other experiments dealt with the effects of glucose, phosphates and drugs (pervitin, caffeine, cardiazol, veritol, etc.) on work. It was studied how muscular work influences the behaviour under low oxygen tension. The effects of vibration on men were

WA-5276 3

another item of research. Experiments concerning dark-adaption and vision in twilight were undertaken to determine the lowering of the work output in ill-lighted working places.

B. Practical Industrial Physiology

1. Description of external working conditions and their effect on workers.

(a) Working place. An exact description of the place of work and of the specific performance of work in it gives a standard for the evaluation and improvement of professional work. Detailed time and motion studies during the whole working day were undertaken chiefly in coal mines and in one steel and iron industry.

(b) Physical Effort:

1. Intensity of work. The intensity of work, measured in calories, has been over-looked in many occupations.

2. Nervous effort. A method was introduced for the continuous control of effort, adaption and fatigue during the whole day in time-fixed work (conveyor work). The compensation for an insufficient disposition to work by applying extra will-power is claimed to be an important factor in the so-called "nervous effort" syndrome. The participation of the brain in more or less automatic work was tested. To clarify the causes of "fatigue" they analysed how far it is due to an habitually bad performance of work or to actual over-work.

(c) Nutrition of workers: To study the nutrition of workers they selected statistical data on nutrition under physiological conditions with Hollerith machines. They used data collected by themselves on miners as well as the numerous data collected by the "Statistisches Reichsamt" for nearly all occupations. The consumption of food-stuffs and calories were related to wages and intensity of work. Investigations on the work done by Russian slave-labor workers under increased rations showed clearly the connection between nutrition and amount of work done, and led to a general increase in the rations for these workers.

(d) Additional factors increasing the effort. Other factors which render work more difficult such as uncomfortable atmospheric conditions, insufficient illumination, noise, dust, co, unsuitable clothes were registered in the usual physical and chemical terms. Their influence on work output was then measured.

2. Measures applicable for increasing professional work output.

(a) Improvement of working conditions:-

1. Design of tools and machinery in relation to their operators. It was shown that tools used in agriculture, and forestry vary widely in design all over the country, thus inducing very different

energy expenditures. This is especially true of antique implements such as shovel, spade, hammer, scythe and saw. They made it a point to find forms inducing the least possible energy expenditure and fatigue. A special knife for scraping pines (to collect resin) was examined on the same lines. They published reports on the correct form of staircases and ladders, and on the best arrangement of handwheels, handles, and pedals. The efficiency of bicycling and wheel-barrow pushing was investigated.

Much work was done on solving the problem of constructing compressed-air-driven hammers, devoid of reactions and damage to the operators.

2. Optimal performance of work:- The optimal performance of elementary work, i.e., of types of work which are found to be parts of complicated procedures, were thoroughly studied. Thereby, they found out which way and which speed is optimal for lifting weights, for turning a crank, for pushing and pulling in horizontal and vertical directions, for carrying weights on a horizontal or inclined plane. Other reports dealt with the exertion induced by milking and house-keeping.

3. Influencing the course of work:- Based on the general results of research on rest pauses, optimal arrangements of rest pauses as to length, regime and number of pauses were introduced in factories. The study of the physiological work curve which shows to the workman at any time the ratio of his actual to his physiologically optimal working speed, thus enabling a free and easy adaption ("Arbeitschauhr")

For the time-fixed work on the conveyor belt, the speed of the latter was regulated according to the physiological "readiness" for work. This method resulted in lower fatigue and less mistakes in spite of the unchanged or even higher output.

(b) Improvements in the physical condition of the worker.

1. Influence of training on work. Good work is based on careful education and conditioning of the worker. The "Arbeitschauhr" mentioned above has proved a timesaver in schooling new workers for the correct working speed.

2. Appropriate nutrition and intake of liquids. Finding the appropriate nutrition for every kind of occupation was the aim of experiments on nutrition. Careful studies of workers performing heavy work showed clearly the needs of proteins, of vitamins, especially vitamin B1, necessary to maintain working capacity and with the problem of how to assure this quantity with the usual food supply.

An adequate amount of drinking water must be assured for work aggravated by heat. Experiments on colliers resulted in finding that a decrease of work during the shift is often due to an insufficient supply of beverages.

(c) Ultraviolet radiation:- Ultraviolet radiation as a means of maintaining health and increasing work was introduced in coal mines on their recommendation. Workers were exposed to heavy doses of this

light while putting on their clothes, and while bathing after work.

3. Summarization of a portion of the Publications of the K.W. Institut für Arbeitsphysiologie for the years, 1942, 1943 and 1944.

(a) Publications dealing with the physiology of work and fatigue.

1. Müller, E.A. : Pulse rate as an indicator of the metabolism and fatigue of the working muscle.

Arbeitsphysiologie 12, 92-104, 1942

Summary :

a. Slowing of the pulse during constant oxygen intake is peripheral and not caused by "training" of the heart.

b. Slowing of the pulse in "training" is regarded as a consequence of a reduction of the heart-minute volume which itself is a result of improved vascularization and oxygen consumption of the heart muscle.

c. Efficiency increases during training as the result of an improved exchange between muscular tissue and the available oxygen.

d. With a constant oxygen intake, changes in the type, arrangement, and velocity of work, especially in untrained individuals, results in wide variation of the pulse rate. An increase in the duration of the work is always associated with lower pulse frequencies and vice versa. It is assumed that changes in pulse frequency indicate changes in the minute-volume.

e. The relationship between the increase of the minute-volume caused by work and the increase in energy output is indicated satisfactorily by the relation pulse frequency/energy output. This relationship is termed the "Pulse-quotient" of the Energy output.

2. Hamar, N. and Szakall, A. : On the behavior of blood and urine potassium during muscular work in untrained and trained dogs.

Arbeitsphysiologie 13, 140-150, 1944

Summary:

Potassium level of the blood and potassium excretion in the urine are measured in trained and untrained dogs under conditions of work and rest. While resting a continuous small loss of potassium takes place. Untrained animals showed an increased blood and urine potassium level drops below the original value, excretion decreases slowly. In trained

animals, however, the blood potassium drops during work and rises during the recovery period.

3. Lehman, G. and Michaelis, H.F.: Adrenalin and Work, III Report, the adrenalin level of the blood during muscular activity Arbeitsphysiologie, 12: 298-314, 1943.

Summary:

It is shown in animal and in human experiments that the adrenalin content of the blood decreases during muscular work. The greater the work out-put the greater the fall in adrenalin concentration. This relationship, however, is based rather on the degree of exertion (Anträngung) than on the volume of work.

4. Lehman, G. and Michaelis, E.F.: Adrenalin and Work, IV Report. Arbeitsphysiologie, 12: 305-312, 1943.

Summary:

Daily variations of the blood-adrenalin-level are studied. A curve with two spikes (morning and afternoon) is found. A close relationship between work efficiency and adrenalin blood level is established in a larger number of humans.

5. Lehman, G. and Michaelis, F.H.: Adrenalin and Work. VI Report. The Ergotrope reflex. Arbeitsphysiologie, 12: 440-48, 1943.

Summary:

Stimuli, such as noise, submersion of the hand in cold water, light, evoke a reflex excretion of adrenalin.

6. Müller, E.A. and Müller, S.: Work physiological studies on wheelbarrows. Arbeitsphysiologie 13: 1-8, 1943.

Summary: Testing of various types of wheelbarrows from the point of view of energy metabolism.

7. Szakall, A.: Maximum efficiency and maximum work. Arbeitsphysiologie, 13: 9-41, 1943.

Summary:

An attempt is made to evaluate the work of efficiency of human beings by establishing certain physiologic criteria consisting of the determination of maximal work efficiency value and work output maxima under conditions of reduced efficiency. The result of these measurements in 40 individuals is discussed.

8. Hamar, N. and Szakall, A.: The effect of insuline and muscular work of the magnesium level of the blood serum and urine.

Arbeitsphysiologie, 13: 42-48, 1943.

Summary:

In perineotonized dogs, the variations in the Serum-mg-levels and the Mg-excretion in the urine are studied after insulin injection during muscular work periods. The serum-mg-level and blood-sugar levels drop simultaneously after insulin injection but subsequently reach their original levels. From then on the Mg concentration gradually begins to decrease again whereas blood-sugar values remain unchanged. This behaviour is maintained during work periods.

9. Hamar, N., Michaelis, H.F. and Szakall, A.: Adrenalin and work V Report. The influence of training on the adrenalin content of the blood of dogs. Arbeitsphysiologie, 13: 57-62, 1943.

Summary:

The adrenalin concentration of blood taken from the saphenous vein of trained and untrained dogs under conditions of rest and work is determined. During rest the adrenalin level remained fairly constant (2.2 - 2.3 l cc plasma) during the day. Muscular work in untrained animals produces a decrease in the adrenalin level. During the recovery period the level rises slowly but even after 7 hours does not attain the original level. In the event of previous training no change in the blood adrenalin level during work was observed.

10. Lehman, G.: The evaluation of physical work on a physiologic basis. Steel und Eisen. 64: 85-90, 1944.

Summary:

A paper discussing various aspects of the physiology of work, especially the evaluation of work efficiency.

11. Graf, O.: The problem of monotony of work and its elimination. Arbeitsphysiologie, 13: 95-100, 1943.

Summary:

Discussion of methods to prevent fatigue due to monotonous working conditions.

12. Lehman, G. and Szakall, A.: Studies concerning the increase of work efficiency by exposure to ultraviolet light. Arbeitsphysiologie, 13: 101 - 113, 1943.

Summary:

Erythema doses of ultraviolet light are required to produce increases in work efficiency.

13. Hamar N. and Szakall, A.: On the behaviour of the urine pH during prolonged muscular activity and subsequent recovery. Arbeitsphysiologie, 13: 114-124, 1944.

Summary:

During protracted hard work, alkaline urine is excreted. During the subsequent period of recovery, gradual reacidification of the urine takes place. The cause for the alkalization is probably increased potassium excretion and simultaneous retention of phosphates. The alkaline "work-urine" is associated with an increased excretion of bicarbonates.

14. Graf, O.: A method devised to control work velocity according to previously established "work-curves", for the purpose of regulating work on a physiologic basis.

Arbeitsphysiologie. 13: 125 -139, 1944

Summary:

Discussion of a device (Arbeitsuhr) designed to establish optimal working velocity. This apparatus is applicable to various types of working processes.

15. Hazar, N.: Potassium, Water and Creatinine excretion of untrained dogs during muscular work and recovery.

Arbeitsphysiologie, 13: 151 - 156, 1944.

Summary:

Potassium concentration in arterial blood increases during muscular activity, reaches original values during the recovery period and then drops below the original level. Potassium in the urine increases enormously during work, during the first hour of recovery it returns to original level but then increases despite low blood-potassium-level. Concludes that the cause of the increased potassium excretion during muscular work is attributable to the rise of the blood potassium level. Increased potassium excretion during the recovery period is probably due to reduced potassium reabsorption in the kidney tubules and increased glomerulus filtration.

16. Droese, W.: The effect of glucose and glucose B1 combinations on the efficiency during work in high temperatures.

Arbeitsphysiologie 12: 124-133, 1942.

Summary:

The work efficiency of 14 individuals was tested on the bicycle ergometer at normal and elevated temperatures under the influence of glucose and glucose-vitamin B1 mixture. It was found that in high temperatures only the glucose-vitamin B1 mixture produced an increase in work efficiency and it is concluded, therefore, that under such conditions and increased demand for B1 exists.

17. Szakall, A.: Work physiologic studies during mowing with a new type of sickle. Arbeitsphysiologie 12: 1-14, 1942.

Summary:

A new energy-saving mowing instrument is described.

18. Müller, E.A.: The problem of combating fatigue. Deutsch. Med. Wachr. # 49: 1940, 1941

Summary:

A general discussion of the methods and the goal of the physiology of work.

19. Müller, E.A.: The pulse quotient as a measure of muscular fatigue. Arbeitsphysiologie 12: 320-331, 1943

Summary:

The degree of fatigue is measured during various forms of exercise by the ratio: pulse-rate/oxygen consumption. The smallest "fatigue values" were observed during bicycling. They increased progressively with the following types of exercise: Cranking, Mountain-climbing, weight-lifting, milking and mowing.

20. Lehmann, G. and Michaelis, H.F.: Adrenalin and Work, 11 The normal adrenalin content of the blood. Arbeitsphysiologie 12: 264 - 271, 1942

Summary:

With the fluorescence method measurements of the normal adrenalin level are carried out in various animals and in men. Considerable variations are found during the period of one day.

21. Michaelis, H. and Müller, E.A.: A work physiological study of milking. Arbeitsphysiologie 12: 249 - 263, 1942

Summary:

The energy expenditure during milking by hand is measured.

22. Müller, E.A. and Müller, A.: The energy expenditure required for respiration in man. Arbeitsphysiologie 12: 192 - 196, 1942.

Summary:

The energy consumption during spontaneous hyper-ventilation and constant alveolar CO₂ tension is determined.

23. Graf, O.: A method for the examination of the pharmacologic influence of various drugs on coordination.

Arbeitsphysiologie 12: 449 - 468, 1943

Summary:

The influence of Phosdrom alcohol, Caffeine, and Pervitin is studied by means of an automobile-like psychotechnical testing device.

24. Lehmann, G., and Michaelis, H.F.: Adrenalins and Work, Report 1. Perfection of the fluorescence method for the determination of Adrenalin. Arbeitsphysiologie 12: 52 - 80, 1942.

Summary:

Description and evaluation of the fluorescence method for the determination of adrenalin in plasma.

25. Michaelis, H., and Müller, E.A.: The significance of the alveolar CO₂ tension for the determination of the energy consumption of respiration. Arbeitsphysiologie. 12: 85 - 91, 1942.

Summary:

Oxygen consumption for respiration during increased ventilation (caused by breathing of air-CO₂ Mixtures and muscular activity) decreases as the alveolar CO₂ tension increases. This phenomenon is attributed to a metabolic depression in the presence of a rising alveolar CO₂ tension.

26. Müller, E.A.: Heart insufficiency and heart tons.
Ztschr. f. Kreislaufforsch 34: 297-304, 1942.

Summary:

It is shown in the Starling heart lung preparation that contractility and tone are closely associated in their behaviour to damaging influences and to the therapeutic influences (glycosides, Veritor, Sympatol.).

27. Müller, E.A., Michaelis, H. and Müller, A.: The influence on energy consumption of the alveolar CO₂ tension during rest and work.
Arbeitsphysiologie 12: 313-319, 1943.

Summary:

The individual alveolar CO₂ tension is one of the determining factors of the basal metabolic rate.

WA-5276 3

(b) Publications dealing with miscellaneous subjects such as Nutrition, Industrial, Hygiene, Physiology, etc.

1. Michaelis, H.F.: The influence of anesthesia on the adrenalin content of the blood.

Arch. f. experim. Path. u. Pharmacol. 201: 580-588, 1943.

Summary:

Cats were found unsuitable to determine the influences of anesthesia on the blood adrenalin level. Experiments on dogs showed that with the absence of all disturbing influences (cooling, noise, light, pain, etc.) a preliminary increase of the adrenalin level takes place (excitation stage) irrespective of the type of anesthetic. Subsequently, a fall in the blood adrenalin level occurs: this is also independent from the type of anesthetic. The following drugs were tested: Ether, Chloroform, Peryocton, Evipan, Chloranhydrate, Veronal-sodium.

2. Kraut, H. and Wecker, H.: Calcium balance and Calcium requirements. Biochem. Ztschr. 315: 329-344, 1943.

3. Szakall, A.: Changes in the upper layers of the skin after continued use of some washing materials.

Arbeitsphysiologie, 13: 49-56, 1943.

4. Droese, W.: Experimental studies on the provision with Vitamin B1 of the urban population in the years 1941, 1942 and 1943.

Arbeitsphysiologie 13: 63-78, 1943

Summary:

Study on the distribution of B1 deficiencies in the city of Dortmund during the years 1941, 1942, 1943. With a daily intake of 2400 cal. (of which 1700 - 2000 not derived from fats) a daily requirement of 1000 to 1200 vitamin B1 is thought to be sufficient.

5. Lehmann, G. and Michaelis, H.F.: Tobacco and adrenalin level. Arch. f. experim. Path. u. Pharmacol., 202: 627 - 632, 1943.

Summary:

With the fluorimeter method, the influence of tobacco smoking and chewing on the adrenalin level is determined. The less nicotine present in the smoking material, the greater is the rise in the adrenalin level. "Strong Cigars", cigarettes evoke a fall in the adrenalin level. A similar behavior was discovered in the case of chewing tobacco.

6. Kraut, H. Weischer, A. and Hügel, R.: The tolerability of synthetic fat derived from fatty acids with 6 to 12 c atoms.

Biochem. Ztschr. 316: 96-107, 1943.

Summary:

WA-5276 3

The preparation and properties of a synthetic fat prepared from fatty acids (Fisher-Tropsch synthesis) are discussed. The behavior toward pancrease lipase is studied. The synthetic fat consisting of a fatty acid mixture extending from capronic acid to laurinic acid is similar to natural fats in its behavior towards pancrease lipase.

7. Lehmann, G. and Müller, E.A.: Ultraviolet irradiation and high altitude tolerance. Luftfahrmedizin, 9: 37-43, 1944.

Summary:

No improvement of the tolerability to high altitude was observed after exposure of a number of individuals to ultra-violet rays.

8. Müller, E.A., and Michaelis, H.: The reasons for individual variations in the tolerability of high altitudes. Luftfahrmedizin, 9: 44-48, 1944

Summary:

The resistance to high altitude of 48 individuals between the ages of 21 and 29 years was tested by means of the rebreathing test. No correlation with the hemoglobin content was found, however, a good correlation with alveolar high latitude resistance and with the relationship alveolar ventilation-oxygen intakes was found. Both increase with the body weight (irrespective of panniculus adiposus). A slight increase of the tolerance to high altitude with the age was established.

9. Kraut, H. and Weber, W.: On the lead content of hair. Biochem. Ztschr. 317: 133-148, 1944

10. Kraut, H., Weischer, A. and Hügel, H.: The tolerability of synthetic fat derived from fatty acids with from 6 to 12 C-atoms. Biochem. Ztschr. 317: 187-192, 1944.

Summary:

Studies on rats and dogs show that the absorption of synthetic fat of the above composition is equal to that of Soya oil. Respiration experiments in rats revealed that the respiratory quotient after feeding synthetic fat is equal to the H.Q. observed with vegetable rats.

11. Kraut, H. and Bramsel, M.: The protein consumption of the German population in the year 1927/1928 calculated on the basis of 100 households. Arbeitsphysiologie 12: 222-237, 1942

12. Kraut, H. and Bramsel, H.: The caloric requirements of various professions in Germany 1927/1928
Arbeitsphysiologie 12: 198-221, 1942

13. Kraut, H. and Rohdwald, M.: The carbohydrates and fat requirements of the German population 1927/1928 based on 2000 household
Arbeitsphysiologie 12: 232-248, 1942.

14. Kraut, H. and Rohdwald, M.: The carbohydrate metabolism of the B1 avitaminotic pigeon.
Biochem. Ztsch. 312: 289-307, 1942.

15. Kraut, H. and Weber, M.: The determination of silicic acid in the blood.
Hoppe-Seyler's Ztsch., f. Physiol. Chem. 275: 127-237, 1942.

16. Droese, W. and Bramsel, J.: Vitamin-Table, Heihefbö zur Ztsche. "Die Ernährung" Heft 8, 1943

Summary:

An excellent collection of data on vitamin requirements and on vitamin content of certain common foods.

4. Tonhormone

Our attention was called to a new preparation called Tonhormone, a chemical combination of adrenalin and ascorbic acid. It was developed at the Byk-Gulden Chemical Works at Cranienburg, just outside of Berlin. Animal experimentation was done by Dr. Peter Marquardt at the Pharmaceutical Department of the University of Berlin, and later it was used in the Internal Medicine Clinic at the Charite Hospital at Berlin. It is given by mouth and has a longer action than adrenalin because it oxidises more slowly and excretion does not begin for 6 or 7 hours. It is said to be of special value in circulatory diseases and in urticaria. Tonhormone was described by Marquardt, P. and Aock, R., in the following publications:

- a. Schweizer Med. Wachr. 1940, # 36
- b. Zeitschr. f. Exper. Med. 1941, 109, p. 488
- c. Archiv. f. Exper. Path. u. Pharm. 1944, 202 p. 658

5. Comments

a. This institute appears to be well equipped, well staffed and well managed. It is claimed to be the only one of its kind in Germany. Supplies and equipment are sufficient to permit a continuation of research for several months. Funds are limited but the staff is willing to work without pay for a period of up to six months.

b. Full exploitation of this target would require a visit by a specially qualified physiologist.

#13,388

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Indexed



War Dept, Combined Intelligence Objectives
Subcomm. Report #64